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Ubiquitous Car Monitoring System

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Abstract: In today's world road accident is the main cause of many deaths. There is no such application developed which can detect the accident and notify it to the driver's relatives or to the hospital to provide the emergency services. Smart phones are being used for developing such smart applications for smart cities. The smart phone senses the parameters, computes the results and communicates with the server. This paper proposes a system which aims to provide cost effective means of determining the performance of the vehicle and tracking the vehicle by transferring the obtained data to an android device by using a Bluetooth controller. An electronic hardware unit is developed to carry out the transfer of the information between the vehicle's on board system and the mobile phone which in this case is an android device. The results are then analyzed on the basis of the communicated data and viewed by the user or the owner to monitor the fuel consumption and the other important electromechanical parameters of a vehicle. The alarm alert systems i.e. A Buzzer is used to notify the driver or the admin about the results. This is done by using the interface sensors, grab sensors ADC values and applying the threshold conditions on those values. Alerts are generated if the threshold values are crossed. A message can be sent from an android device to the nearby hospital for providing emergency services in case of severe accidents. The sensors used are the Temperature sensor, Seat Belt detection sensor, Alcohol detection sensor, Fuel level detection sensor, Accident detection sensor, Drowsiness detection sensor (IR).The roads with bumps and pits are indicated to the driver by using an accelerometer present in the android device. The mobile device is capable of transmitting data to the server using cellular internetwork connection-WIFI.

Keywords: Android device, Threshold values, WIFI, Bluetooth, Accelerometer, Sensors, electromechanical parameters, Alarm alerts, Server.

I. INTRODUCTION

It is divided into 3 parts:
A. Vehicle Monitoring.
B. Pothole/bump Detection.
C. Accident Detection.

A. Vehicle Detection

Nowadays there has been a boost in commercialization of vehicles, especially cars. People prefer to use their vehicles as a source of income by lending them on contract basis to various agencies. There are various cons associated with such kind of business. An owner is continuously tensed about the well- being of his vehicle as to how the intended driver is using his vehicle. There have been numerous cases of car robbery, drink and drive, fuel robbery, improper handling of the car and many more. Such kind of behavior creates a need to develop a system which would help the car owners keep track of their vehicles so that immediate action can be taken on the miscreants. In this paper we propose to develop a ubiquitous car monitoring system which will serve this purpose. With the help of various hardware sensors installed at appropriate positions in a car various parameters can be sensed. The state of driver like whether he is drunk or whether he is sleepy will be monitored and accordingly we can raise an alarm. The system will also check whether the driver is using his seat-belt. It will also keep a track of the fuel used using a fuel level detector. All this information will be communicated to the admin i.e. the car owner so as to keep him informed which will help him to monitor his car. All the communication between the sensors and the owner would be through a mobile device, here an Android device.

B. Pothole/bump Detection

As we all know Potholes are nothing but the holes which are encountered on the roads, are of size 50mm and wider than 75mm in any horizontal direction. Areas where the drainage facilities are poor are more prone to potholes development. Nowadays, potholes are becoming the main cause of road accidents and many deaths of young lives. We have searched some statistical and analytical information about the deaths and the accidents caused last year from the latest and updated newspapers. Using an android device we can easily detect the potholes, bumps and pits on the road. Accelerometer and the GPS system present in any android device, in this case a mobile phone, helps in detecting and informing the driver about the presence of the pits and potholes on the road and thereby helps in avoiding accident.

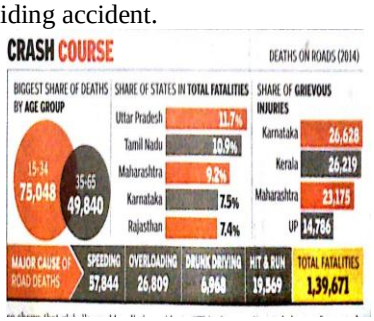

Fig.1 Statistical Data – 1

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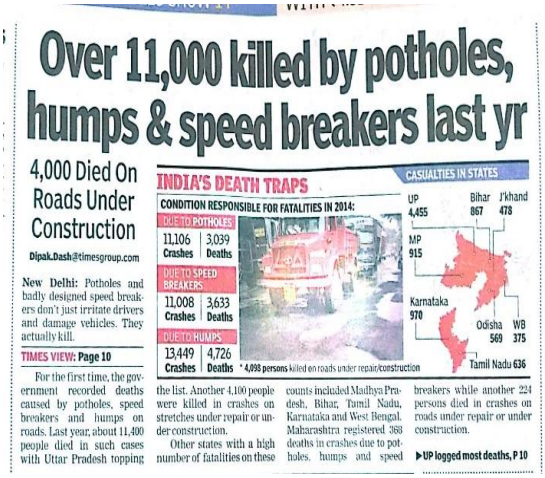
The Fig.1 and Fig.2 shows the death on roads due to potholes and bumps in 2014 in various major states.

C. Accident Detection

Traffic accidents have nowadays emerged as major issue to everyone as its frequency is incrementing steeply. Accidents are mostly unavoidable but many surveys shows that long response time taken to address the victim in emergency is the primary reason for increase in death rate. We can reduce this by minimizing the response time it takes to address the accident. Smartphone have evolved as promising technique to detect accidents. Nowadays smart phones are available everywhere and that to with network connectivity which are considered as perfect device to immediately inform the emergency authorities. Smart phones are loaded with advance and complex support system like GPS, accelerometer, light and other build-in sensors which can be exploited intelligently.

Most smart phones support wireless data network services such as SMS, GPRS and 3G/4G which can harness the data from sensors and network connectivity. Four wheelers are usually involved in most of accident especially on highways. In this paper various network systems aspects are used to work together with an Android operating system. As smart phones are cheap and loaded with many sensors and network proficiency, it is highly advisable to use smart phone application to detect car accidents. Along with SMS facility smartphones also have GPS which will help in locating the place of the accident and thereby providing the location of accident. This immediate location identification can help in emergency services.



Over 11,000 killed by potholes, humps & speed breakers last yr

4,000 Died On Roads Under Construction

Dipak.Dash@timesgroup.com

New Delhi: Potholes and badly designed speed breakers don't just irritate drivers and damage vehicles. They actually kill.

TIMES VIEW: Page 10

For the first time, the government recorded deaths caused by potholes, speed breakers and humps on roads. Last year, about 11,400 people died in such cases with Uttar Pradesh topping the list. Another 4,100 people were killed in crashes on stretches under repair or under construction.

Other states with a high number of fatalities on these counts included Madhya Pradesh, Bihar, Tamil Nadu, Karnataka and West Bengal. Maharashtra registered 368 deaths in crashes due to potholes, humps and speed breakers while another 224 persons died in crashes on roads under repair or under construction.

▶UP logged most deaths, P 10

INDIA'S DEATH TRAPS

CONDITION RESPONSIBLE FOR FATALITIES IN 2014:

DUE TO POTHOLES: 11,106 Crashes | 3,039 Deaths

DUE TO SPEED BREAKERS: 11,008 Crashes | 3,633 Deaths

DUE TO HUMPS: 13,449 Crashes | 4,726 Deaths

* 4,098 persons killed on roads under repair/construction

CASUALTIES IN STATES

UP 4,455 | Bihar 867 | J'khand 478

MP 915

Karnataka 970

Odisha 569 | WB 375

Tamil Nadu 636

Fig.2 Statistical Data – 2

II. BLOCK DIAGRAM

In the Fig. 3 we can see the general layout of system which we are going to develop. We will briefly go through the various components portrayed in the figure.

Android phone: We can use any smartphone having android OS installed in it. It should have few basic sensors like accelerometer and location sensor, internet connectivity and preferably a SMS pack.

Server: All the data received from the Android smartphone will be will be stored in a database(MySQL) and a java application will be used to show appropriate notifications.

Sensors: For recording all the required electromechanical parameters we are using various sensors like fuel, temperature, seat-belt, alcohol, drowsiness, and accident. The system will also use motion and location sensors from the android device.

Bluetooth: For transmission of data from the external sensors to the mobile device the system will use a Bluetooth module.

Buzzer and stepper motor: These devices would be used as an alarm or counter action if any unwanted activity is detected by the sensors.

Microcontroller: A microcontroller will be used to coordinate all the activities of all the hardware components. The microcontroller which we are using has an inbuilt ADC.

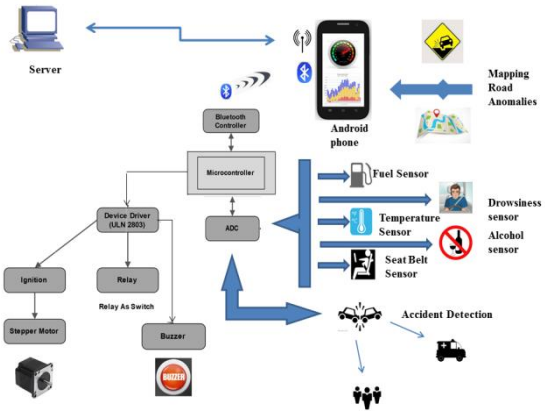


Fig.3 Block diagram of the proposed system

III. WORKING

The overall working of the system is divided into three parts:

A. Hardware
B. Android
C. Server(Java application)

A. Hardware

Acquiring electromechanical parameters: In this project we are measuring various parameters like fuel level, seat belt, temperature, alcohol, drowsiness, accident of the particular vehicle. For this we are going to setup various sensors which will help in measuring or capturing these parameters.

i. Fuel level - Potentiometer
ii. Alcohol - MQ 3 alcohol gas sensor
iii. Drowsiness - IR sensor
iv. Temperature - Thermistor
v. Seat belt - Switch
vi. Accident - Switch

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The captured sensor values will be communicated to the Android mobile using Bluetooth communication. HC-05 Bluetooth module is being used in the system. It is a SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. We also have 2 devices i.e. a stepper motor and a buzzer. In case high temperature is detected or the driver forgets to wear the seat belt then the alarm would start beeping, on the other hand in case of alcohol detection, with the help of stepper motor we are depicting that we won't allow ignition in case of such event. ULN is used as a device driver. All these hardware components, sensors, Bluetooth, ULN would be controlled using a microcontroller, here ATMega32(AVR). This microcontroller has an inbuilt ADC(Analog to Digital converter) for converting the analog signals captured by the sensors into their respective forms.

In Fig 4 we can see the circuit diagram of the hardware being proposed and how it is to be interconnected. The sensors will be connected to the input ports of the microcontroller (PA0-PA7). These acquired analog values will be converted into their digital form and given to the Bluetooth module (PD0/Rx-PD1/Tx). The diagram also shows the sensor output going to MAX232, it is basically used for testing purposes. In the system we need to control some devices like stepper motor and buzzer. For this we are using ULN device driver. Ports PB(PB0-PB7) of the microcontroller can be used to send out particular signals to the ULN which will thereby control the respective device.

B. Android

The Android application i.e. 'Vehicle Tracking' has a simple GUI. Firstly the driver (client) has to enter the domain name(IP address) of the admin(server) it wants to get connected along with the contact number he wishes to contact in case of emergency(here mostly admin) as shown in Fig 5. After entering his valid username and password the driver (client) will get entry into the application and he has to pair the device with the HC-05 Bluetooth module. If desired some scaling values can be set (generally left to 1), refer Fig 6. After this the driver has to start the application using the respective button. The current status of all the sensors will be displayed as shown in Fig 7.

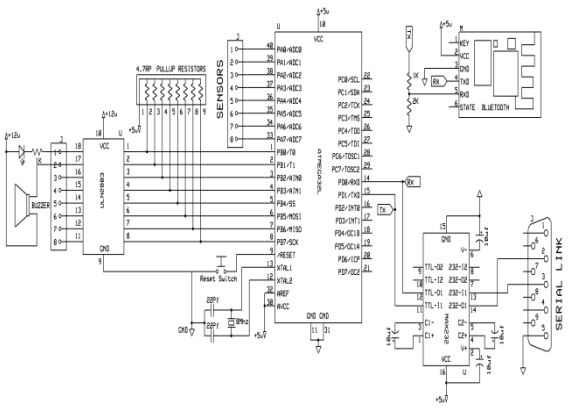

Fig 4: Circuit diagram(hardware)

Fig 5

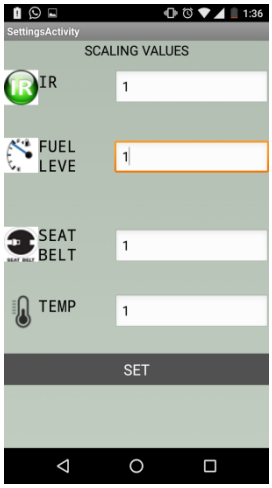

Fig 6

He can adjust the threshold values of temperature, fuel and alcohol sensor using the respective slider. However these adjustments are recorded on the admin side as well to avoid any mischief.

In this application the sensor values received through Bluetooth are compared with the threshold values and in case of any unwanted behavior the yellow bar turns red, refer Fig 8.

In case of high temperature and if seat belt is not detected then using Bluetooth we are communicating back to the hardware to raise an appropriate alarm using the device driver. Same procedure is followed if alcohol is detected, only in this case stepper motor is controlled instead of alarm.

Fig 7

Fig 8

In case of accident we have a function for sending a SMS to the previously entered contact number, containing the location of the victim. This mobile application will be continuously sending the sensor values along with its current GPS location to the server. Another application will be developed to run in background which with the help of mobile accelerometer will help in mapping i.e. latitude and longitude of the pothole/speed bump detected.

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C. Server

The server (admin) will be authenticated first, Fig 9. Once in the application he will be able to see the status of all the sensors visually. There is a section where he can see the latitude and longitude (GPS location) of the vehicle along with the date and time of when those values have been recorded. The server side will also be comparing the received sensor values with the threshold. As soon as some sensor value crosses the threshold then appropriate notification can be seen on the application as shown in Fig 10.

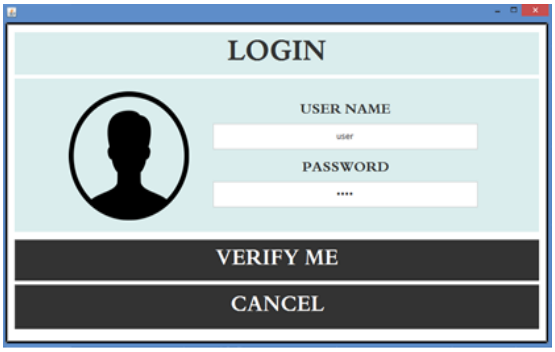

Fig 9

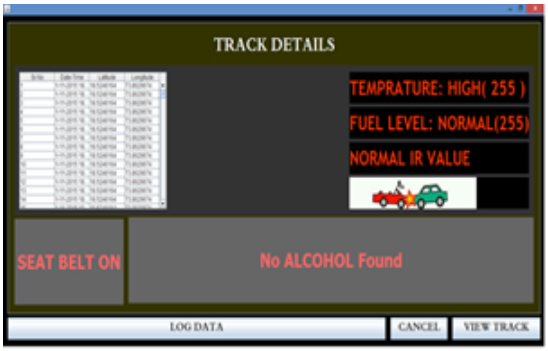

Fig 10

There is a button called 'Log Data' in the application using which the admin can see all the recorded sensor values along the manipulative threshold values. Using 'View Track' button he can locate his current position of his vehicle.

IV. ALGORITHM

In the system we are going to basically go on comparing the ADC values with their respective thresholds and generate appropriate notification to help the admin monitor the vehicle and it also helps in providing safety. We will see the pseudo code for the same:

```
//Check TEMP
if(temp sensed >temp thr)
temp high
raise notification
else
temp normal

//Check Fuel Level
if (fuel sensed <fuel thr)
fuel low
raise notification
else
fuel normal

// for IR
if (ir sensed >= some constant)
DROWSINESS DETECTED
raise notification
else
NORMAL IR VALUE

//for accident
if (accident sensor==0)
accident detected
raise notification
send sms
else
No Accident

//for seat belt
if (seat belt sensor <= 10)
SEAT BELT ON
else
SEAT BELT OFF
raise notification

//for alcohol
if (alcohol sensed >alcohol thr[2])
alcohol detected
raise notification
else
No alcohol Found
```

V. FUTURE SCOPE

In the developed system, in case of an accident we are sending SMS to some predefined contact. To increase its scope we can track the nearby hospitals using GPS and inform them about the mishap thereby increasing the speed of help being provided. Instead of a PC based java application for the admin we can design an Android application which would be more handy and portable.

We can increase the number of sensors in our system, for example say sensor for women safety etc.

VI. CONCLUSION

Hence we have successfully implemented a system which will help a owner to monitor the well-being of his vehicle and keep track of the driver as to how is he using the vehicle.

The system also provides safety measures for the driver as well as the commuters travelling in it with the help of temperature, accident and seat belt like sensors. The pothole/speed bump application maps the road anomalies, however there are limitations due to location(latitude and longitude) captured using mobile GPS.

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